# The DENTAL DIGEST




JUNE, 1934
Vol. 40 No. 6

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# The DENTAL DIGEST

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# THE CLINICAL COURSE OF PYORRHEA POCKET FORMATION*

WARREN WILLMAN, B.S., D.D.S.
Chicago

IN ORDER to follow the clinical course of the disease complex commonly called pyorrhea, it is necessary to acquire at least a casual knowledge of the mechanism of pocket production. This is not so complicated as it might at first appear, because much of the confusion that exists about the disease today can be dispelled by a simple division of the symptoms into two main classes.

Many classifications of pyorrhea alveolaris have been made in the past, and while they may be of value to a research student, they are needlessly complicated and do not facilitate a working grasp of the subject. A practitioner wants, above everything else, an understanding that will enable him to interpret correctly what he sees clinically and enable him to make an accurate diagnosis and a reliable prognosis.

A complete working knowledge of periodontal disease requires the recognition of two types of pyorrhea. In reality they are virtually two separate diseases, and it is easier to think of them that way. They have long been confused, because they attack the same tissues, frequently occur together, and have a similar terminal picture. The resemblance ends there, however. They have different causes and different symptoms; we have a practical treatment for the one and not the other; and we understand the one and not the other. For purposes of diagnosis and prognosis, therefore, it is obviously essential that we be able to differentiate these two, even when the two appear simultaneously.

Because of the longstanding clinical confusion, these two diseases have been named and renamed literally scores of times, but for the present discussion we shall term the first disease *marginal pyorrhea* and the second, *diffuse atrophy of the alveolar bone* (Gottlieb's term).

## Marginal Pyorrhea

Marginal pyorrhea is a simple inflammatory response to a low-grade local irritation. Probably 90 per cent of gingival disease is of this type. It may be caused by badly fitted crowns, overhanging margins, impactions of food through faulty contact points, or by deposits of calculus. And calculus far outnumbers all other causes in producing marginal irritation.

In order to understand precisely how calculus can cause a pocket we may refer to Plate A, which shows diagrammatically the steps in the production of a pocket secreting pus. Starting with the normal crevice (1), we observe the dentine of both root and crown on the left, the upper end of the cementum, the lower end of the enamel, the upper edge of the alveolar bone, the submucous tissue, and the overlying normal epithelium. It will be observed that the epithelium is attached to the enamel for a considerable width, below the bottom of the gingival crevice. This attachment thus forms a collar or band around the entire tooth, and is of tremendous importance. (This diagram is a camera lucida tracing of an actual microscopic specimen, showing the lingual surface of a lower bicuspid.)

The first step in the departure from the normal consists of a small deposit of calculus in the gingival crevice (2). This being an irritant to the tissue side-wall of the crevice, it is met by the usual response—inflammation. Especially a passive hyperemia and slight hypertrophy may be noted (3). But if there is an hypertrophy of the gingival margin, an increase in depth of the gingival crevice is the automatic result, and thus a place is made for the deposition of more calculus (4). Such a process would soon reach natural limits, however, if another element did not enter in. Owing to the great increase in fluids in this congested tissue, there is an increased pressure exerted on the thin margin of the alveolar bone. This bone, as is well known, is sensitive to any such stimuli, and in this case responds by resorption (5). It must be emphasized that it is not necrotic nor infected, but simply honeycombed by osteoclastic resorption. Macroscopically or to the touch of an instrument, it would seem granular or rough, which fact has been disastrously misleading to some clinicians.

As soon as this alveolar bone is resorbed at the margin, some of the periodontal membrane fibers cease to function and something of the utmost importance happens. The tiny band or collar of epithelium which is attached to the tooth below the bottom of the gingival crevice has an unexplained tendency to migrate, and always root-wise. Ordinarily it cannot do this, because living tissue is in its path. Now, however, when some periodontal membrane fibers are lost and the adjacent tissue becomes inflamed, the epithelial attachment is enabled to grow down (6). It does this by extending root-wise at its lowest point and detaching itself a corresponding amount at the top, keeping the band of attachment at a fairly uniform width all the time. Thus the gingival crevice is enabled to go on indefinitely getting deeper, because not only can the tissue of the gingival margin hypertrophy but the epithelial attachment which forms the bottom of the crevice can migrate root-wise without limit as soon as the underlying tissue is injured enough to permit it.

The greatly deepened crevice admits of greatly increased quantities of calculus (7) with greatly increased inflammation. At this point it might be appropriate to change the name from that of a deep gingival crevice to a pocket. This is an arbitrary but useful term, and can be applied whenever the depth of the crevice exceeds a reasonable normal. It cannot be overemphasized, however, that even if the pocket extends all the way to the root-end, the epithelial attachment is *always* to be found delimiting it at the bottom. The depth of the crevice may change enormously but its characteristic form does not; i.e., the bone, periodontal membrane, and other structures beneath the epithelium are never exposed to infection, nor open to the mouth, as was formerly believed.

After the pocket has developed, the crevice epithelium which has long been insulted and irritated succumbs to infection (8) by whatever organisms are at hand (and this area of the oral cavity is at *all* times one of the most highly infected regions of the entire body), and an ulcer is devel-

*From the Chicago College of Dental Surgery, Dental Department of Loyola University, Chicago.

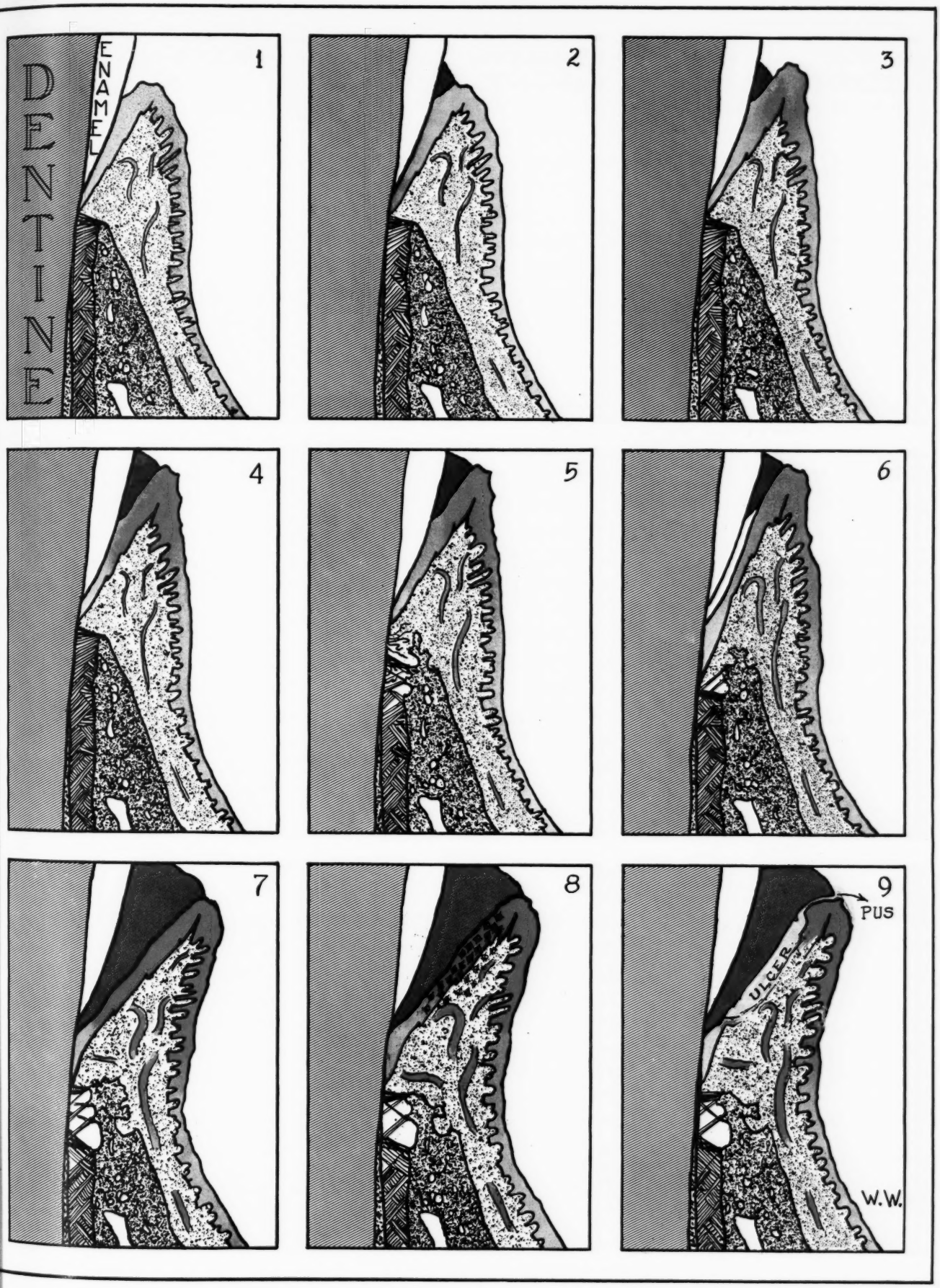


Plate A—Schematic representation of the steps in the development of marginal pyorrhea.

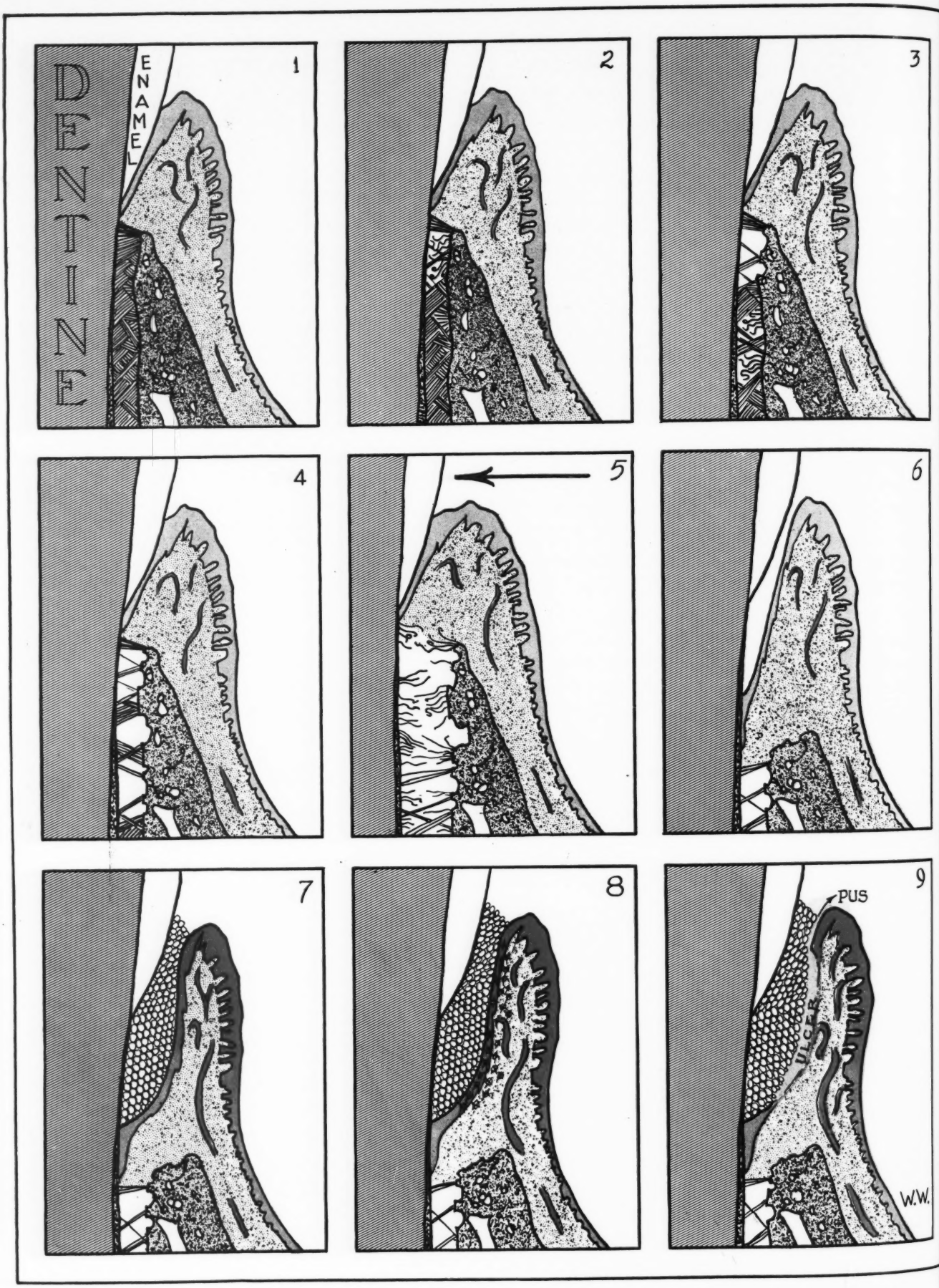


Plate B—Schematic representation of the probable steps in the development of diffuse alveolar atrophy, according to one hypothesis.

oped on the epithelial side wall of the pocket (9). From this ulcer, and not from the periodontal membrane or submucous tissues, flows the pus that originally gave rise to the term pyorrhea alveolaris.

### Diffuse Atrophy of the Alveolar Bone

Diffuse atrophy of the alveolar bone is a much rarer disease and its causes are obscure. It seems certain that something of a constitutional or metabolic nature is responsible for it, but what that something is has so far been the subject of much speculation and little knowledge.

The clinical course of diffuse atrophy is the precise opposite of that of marginal pyorrhea. The three cardinal steps in marginal pyorrhea were (1) inflammation, (2) pocket production, and finally (3) loosening of the teeth. Diffuse atrophy, when it occurs in a mouth previously free from marginal irritation, presents these three stages in reverse order: first, the teeth loosen and wander; after that pockets of a characteristic kind appear; and only after pockets are produced spontaneously does débris accumulate and cause an inflammation. Gottlieb of Vienna has advanced one hypothesis to explain the mechanism of this disease. It follows:

It has been well established that throughout the life small quantities of cementum are constantly being laid down on the root surface of the tooth. This is physiologic and serves several functions, one of which is probably to cement new periodontal membrane fibers to the root surface. The need for this is obvious: like most tissues, the fibers of the periodontal membrane do not last the life of the person. They die off and are replaced by new ones. These newly developed fibers can be anchored into the alveolar bone by a tiny resorption and repair, but they are fastened to the tooth only by the addition of new cementum to the old.

Having this in mind, it is easy to see how the symptoms of diffuse atrophy might be produced. Starting again with the normal picture (Plate B, 1), the first thing that would happen if the cementoblast cells stopped forming cementum would be that new periodontal membrane fibers that were formed to replace old ones would fail to be fastened to the root surface (2). And since the alveolar bone remains present around a tooth only so long as there is a functional pull on it, the bone would soon be resorbed at these points (3). When this condition is extended over a major part of the surface of the alveolar bone, the picture would be as it is diagrammatically represented in number 4, and from this the term, diffuse alveolar atrophy, is derived.

In this way the fibers that normally suspend the tooth in its sockets are egregiously weakened, and sooner or later a strong mechanical push, such as might be dealt even in ordinary occlusion, will be able to tear (5) the remaining periodontal membrane fibers loose, permitting the loosening and wandering of the tooth as the first notable symptom.

But since the epithelial attachment has its own tendency to migrate rootwise, a pocket (6) will appear speedily, on the side of the tooth from which it is drifting, which is the second stage. (At this point it has been termed "dry pyorrhea," because there are pockets and the teeth are becoming loose, without inflammation.) However, once a deep pocket appears, food débris, mucin, and other material susceptible of fermentation and putrefaction will fill it (7) even when the disease occurs in a mouth entirely free from calculus, and in a short while enough irritation to the crevice epithelium will occur to break its resistance to bacteria (8), and these will produce an ulcer, as before (9).

### Comparison of Clinical Courses of Two Types of Pyorrhea

To follow the clinical course of these types of pyorrhea, one must remember the mechanisms by which each one is produced and the picture of each when it occurs without the other.

Marginal pyorrhea begins with a slight gingivitis, in proportion to the irritant present, which increases in severity as the gingival crevices become deeper, until finally pus is produced. The pockets are of an irregular horizontal type, closely following the position of deposits of calculus or other foreign irritants; hence this type was once called "horizontal pyorrhea." The teeth do not become loose until the pockets become so excessively deep that much bony support is lost; even then they do not drift much but simply become "shaky." The mucous membrane becomes more and more reddened, beginning at the very margin, as the disease progresses. The color is a characteristic purplish red, denoting chronic venous stasis, and as the case advances this becomes increased. The surface of the mucous membrane is dull and rough.

Diffuse alveolar atrophy begins with a loosening and wandering of the teeth, from no apparent cause whatever. Any or all teeth may be affected, although the process is most easily observed in the anterior part of the mouth. The teeth may move in any direction except back into their sockets. If they drift into a malocclusion with their antagonists of the opposite jaw, they will be subjected to occlusal trauma, but it cannot be too strongly emphasized that this is secondary and accidental. Traumatic occlusion as such cannot initiate pyorrhea unless something has happened first to the periodontal structures; it can, of course, supply a disastrous amount of additional injury after disease or senility has paved the way.

One rarely sees diffuse atrophy in this initial stage. Usually the pockets on the side from which the teeth are drifting are already present when the patient appears. These are long and sharp, and exceedingly deep in the direction of the long axis of the teeth. (This feature was responsible for this type being called "vertical pyorrhea.") The mucous membrane overlying these pockets is a brighter red than in the case of marginal pyorrhea, denoting a less chronic hyperemia, and the surface of the membrane is smooth and shiny.

As the disease progresses spaces form characteristically between the wandering teeth, and the upper anteriors in particular tend to protrude and extrude and rotate. They do this whether or not they are in occlusion with the lower anterior teeth. A peculiar and unexplained concomitant is a total immunity to caries. This is by no means invariable but occurs so often that it warrants the immediate suggestion of diffuse atrophy.

### Diagnosis and Prognosis

In making a diagnosis of a mixture of these two types of pyorrhea it is only necessary to keep in mind the characteristics of each. Since few adult mouths are entirely free from calculus and its attendant gingivitis, it follows that nearly every case of diffuse atrophy will occur in a mouth where marginal pyorrhea has already progressed to a small or a great degree. The supreme sign is the drifting of teeth and the production of pockets so deep or looseness so great that the amount of local irritation present cannot be held responsible. The absence of caries is an important corroboration. These signs denote the activity of diffuse atrophy just in proportion as they are present.

Roentgenograms are interesting but virtually valueless as diagnostic aids. This is because the amount of decalcification shown does not necessarily correspond accurately with the amount of actual bone destruction present. The loss of bony support can only be judged by testing the firmness of the teeth in their sockets clinically; and also because the position of the epithelial attachment is not shown in a roentgenogram, and it is known that

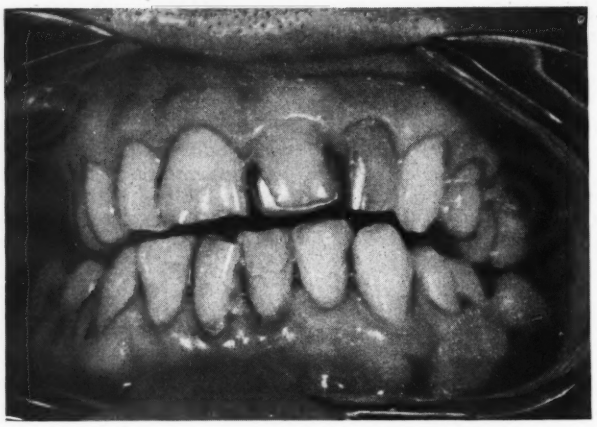

Fig. 1

Fig. 1A

Fig. 1B

Fig. 1C

Ordinary marginal pyorrhea.

there is no constant relationship between the attachment and the crest of the alveolar process. What appears, according to the picture of the bone resorption, to be an excessively deep pocket may, or again may not, turn out to be so when examined with an explorer in the mouth.

In making a prognosis of these two diseases one should simply remember that marginal pyorrhea can be arrested by removing the local irritants responsible (scaling, reducing overhanging margins, restoring contact points, etc.) and obliterating all pockets. (Pockets usually disappear naturally when the inflamed tissue shrinks back to normal after the scaling and polishing of the teeth. A few will need surgical excision, and some bad pockets will indicate extraction of the teeth involved.) On the other hand, diffuse atrophy cannot be arrested by any known means. The superficial symptoms can be treated: marginal irritation removed, pockets excised, and traumatic occlusion relieved, but basically no therapy is known. The prognosis must be made, therefore, on the basis that the more diffuse atrophy complicates the clinical picture, the more pessimistic we become about the outcome of our treatment.

To illustrate, four mouths are shown. Fig. 1 shows a mild degree of ordinary marginal pyorrhea, especially noticeable in the vicinity of the lower incisors. The highlights in the photograph, owing to the moistening of the gingivae with saliva, are deceptive. This tissue is not shiny to the eye, but dull. The congestion and hypertrophy of the tissue can be clearly seen, especially in the region of the two central incisors, where the deposits were heaviest. The teeth are all somewhat crooked, but this is an original malalinement, and is not due to a recent drifting. Roentgenograms of this section are also shown (Fig. 1, A, B, C). A greater amount of decalcification may be observed in the bone surrounding these two teeth, in accordance with step 5 in the scheme of Plate A. The height of the bony crest is also reduced as in number 7 in the same series.

Fig. 2 is a photograph of a mouth showing an early stage of diffuse atrophy of the alveolar bone. Notice the diastema or space between the lateral and central incisors. It is present on both sides, although the camera angle shows only the right. It is important to learn from the patient, if possible, whether such spaces are of long standing or of recent origin. The upper first molars show apparent displacement buccally, which was verified by the pocket production found in the mouth. A slight rotation of the lower right lateral and central incisors has produced a defect in the interdental papilla of gum tissue between them. In the mouth a pocket was found. A few roentgenograms from the full-mouth set are also shown; A and B show the extensive loss of bone around the upper lateral incisors; C shows a characteristic picture of bone destruction on the mesial of the upper left first molar, as does D on the lower right first molar; E shows the region of the lower right incisors.

Fig. 3 shows a severe or advanced case of diffuse atrophy. The position of the upper left central incisor is so characteristic that a tentative diagnosis of this case could be made across the room. Note especially that it has not only protruded and drifted from the lateral incisor, but that it has ex-

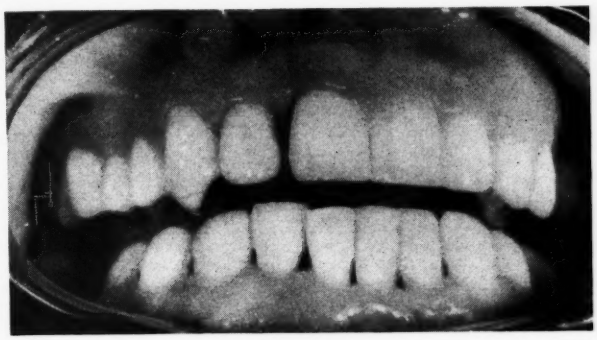

Fig. 2

Mild degree of diffuse atrophy.

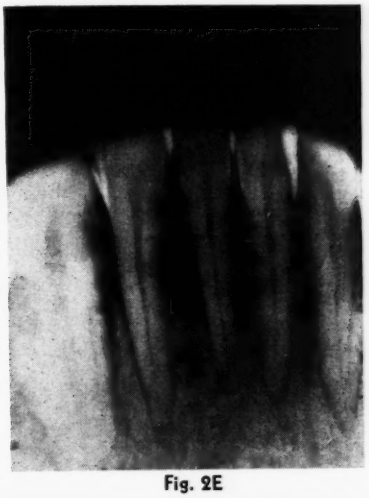

Fig. 2E

Fig. 2A

Fig. 2D

Fig. 2B

Fig. 2C

truded and rotated to the mesial as well. The diastema between it and the lateral incisor is closed in part, owing to the fact that the lateral incisor is also moving away from the cuspid. The lower incisors have drifted markedly and one has already been lost.

The roentgenograms show clearly the devastating loss of bone in several regions. Compare B with C and notice how deceptive a given angle may be. In B the lateral incisor appears to have little bony support while the distal of the central incisor seems to be attached to the bone throughout the apical half of its root surface. From an angle only a few degrees different, C gives a similarly false appearance at the distal of the lateral incisor but tells the truth about the distal surface of the central incisor, for clinical examination had already revealed these two deep pockets. A

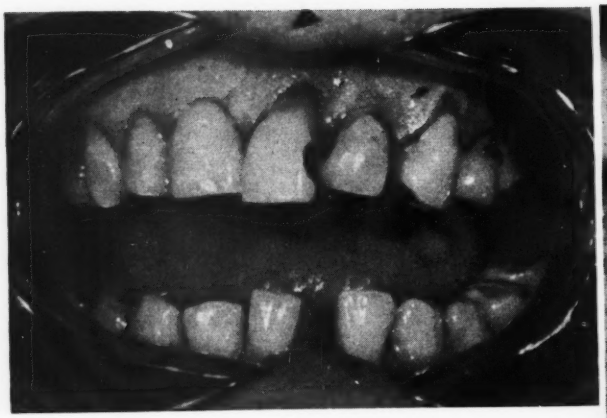

Fig. 3

Fig. 3D

Fig. 3A

Fig. 3B

Fig. 3C

Fig. 3E

Fig 3F

Fig. 3G

Severe diffuse atrophy.

Fig. 3H

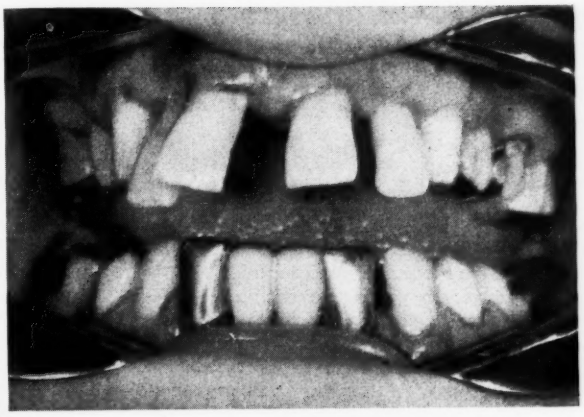

Fig. 4—Hopeless diffuse atrophy.

pessimistic philosophy is not intended here, but it is unfortunately true that the worst picture, in these cases, is always the correct one. From a diagnostic point of view, it should be stated that the retention of teeth as badly involved as the upper left incisors is almost out of the question.

Fig. 4 was made while the patient was en route to the department of exodontia; therefore no roentgenograms were obtained. This shows the last and hopeless stage of diffuse atrophy. The upper right lateral incisor, although in the shadow of the central, may be seen to have extruded to such an extent that the length of exposed cementum equals that of the enamel crown. The teeth were all extremely loose.

These three cases of diffuse atrophy were procured in the college clinic on short notice and by an unusual stroke of bad luck, not one of them exhibits the immunity to caries which is so frequently a characteristic of this disease.

1757 West Harrison Street.

## LETTERS TO THE EDITOR

"Some of our local physicians and dentists are reporting a large number of cases of 'trench mouth' or Vincent's Angina. Some of them consider an epidemic is present.

"The clinical evidence consists of a gingivitis, plus a whitening of the gum margins with some bleeding of the gums and, in more severe cases, definite membranous deposits in the mouth and even on the tonsils. Some cases are attended by pyorrhea. In some instances there is an inflamed condition of the gums varying from slight redness to a more severe type, but without any definite yellowish, grayish, or whitish membrane. Some of these patients have no bleeding of the gums. In some cases, the appearance of the gums is that of a normal person, although there may be around one tooth the slightest redness or possibly a slight whitening of the gum margin. Laboratory diagnoses are generally positive, both for the severe cases and for these very mild cases.

"Symptomatically, it is stated that the patient complains of pain in the abdomen, or pain in the legs and joints, or weakness in the joints. In particular, a tired feeling is noted. Nausea may be present in some cases according to the physicians and dentists. A rise in temperature is usually found, although it may be only a degree or two.

"From the treatment standpoint, these patients apparently respond quickly as far as their symptoms go to intravenous injections of gold sodium thiosulphate, edwinal, neo-arsphenamine, etc. Locally, the case appears to be benefited by various remedies, including sodium perborate.

"There have been a few cases that I thought might be a mild type of 'trench mouth.' Laboratory diagnosis by the local commercial laboratory, and in one instance by the State laboratory, was positive. There have been other cases in which I cannot believe 'trench mouth' exists, although the laboratory diagnosis has been positive and it is stated that the symptomatology, in part or in whole as noted above, has been present. Various questions have arisen in my mind. Is the viewpoint which many of us have held a great number of years, that the organisms of 'trench mouth' are commonly found in many persons' mouths fallacious? Does 'trench mouth,' having the symptomatology as described above, particularly in mild cases, occur in persons who apparently are well? Is there a new type of the disease developing? Why should intravenous therapy varying in nature be effective in similar cases? Have we failed to recognize the systemic symptoms in these mild cases of 'trench mouth' in years gone by? Is the disease highly contagious? Are the organisms commonly found in both school children and adults, and in what percentage?

"I have taken a conservative stand in this matter of 'trench mouth' in the community. Unfortunately, we are unable to do any research work and I thought you might advise me, particularly as to whether the chain of symptoms referred to has been observed in other parts of the country, along with the very very mild cases of 'trench mouth' in which there may be little or no objective signs present.

"I would appreciate hearing from you and will, indeed, value any statement you care to make."—WARREN F. FOX, M.D., *County Health Officer, El Centro, California.*

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"This morning after looking over a sample copy of your magazine, I was so impressed that I immediately entered my subscription. It is indeed a well edited textbook."—JAMES L. PEARSON, D.D.S., *St. Petersburg, Florida.*

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"I wish to take this opportunity of expressing my sincere appreciation for the new DENTAL DIGEST and its contents. It is a work of art and must be appreciated by all dentists, particularly those in foreign countries.

"Please consider me a life subscriber, and if you will send me a bill a few months previous to the date of expiration, I will be grateful as it takes a long time for correspondence to pass between India and U.S.A., and I do not want to miss any of the numbers."—GILBERT W. EKLUND. D.D.S., *Bombay, India.*

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"I have been reading your illuminating magazine for some time now; and I certainly do not want to miss a single issue. It has been a bright spot in my dental literature."—S. LICHTMAN, D.D.S., *Bronx, New York.*

# TRAUMATIC OCCLUSION: ITS DETECTION AND CORRECTION*

SIDNEY SORRIN, D.D.S.
New York

(Conclusion)

PROTRUSIVE OCCLUSION

1. There should be ease of motion from centric to protrusive with no interference. The lower anterior teeth should glide over the lingual surfaces of the upper teeth with such ease that no displacement of the teeth in their sockets will take place.
2. Cusps of teeth interfering in this movement should be relieved.
3. Equal distribution of stresses should be established on the anterior teeth from cuspid to cuspid, if possible.
4. One should try to procure posterior contact, if possible.
5. The problem of the overbite must be considered.

The subject of protrusive relation has long been discussed in great detail in view of the many conditions that are encountered in this position of the mandible. More time should be spent in studying the occlusal habits of the patient, in noting whether his incisive action is produced by a shearing force or by the contact of the incisive surface of the upper with the incisive surface of the lower. If the patient possesses no protrusive relation, it might be wise to give him function in this position, thus permitting a movement of the mandible that had not existed previously. Often it may be advisable to leave well enough alone. Incisive action might be ascertained if on examination the incisal edges are found to be worn. In severe cases of overbite, it may be advisable to advocate orthodontic treatment or to use artificial restorations or inlays to raise the bite.

As the mandible is brought forward in protrusive movement, and some cusp interferes, this offending cusp should be located and relieved, care being taken that, if possible, centric relation is not disturbed. Grinding of the teeth is accomplished by the use of a number 5 or 64 Chayes or the Popper stones, and should so be performed that the principle of cusp form will not be destroyed. Should there be displacement of the anterior teeth in their sockets during this movement, the angle of inclination should be changed. This should be done by grinding the lingual surfaces of the upper anterior teeth from the point of centric contact. This will increase the overjet which is the horizontal distance between the lingual surface of the upper anterior teeth and the labial surface of the lower anterior teeth in the position of rest. These surfaces should present inclinations that have essentially the same relationships of the cusp surfaces of the posterior teeth. If these inclined planes are out of mechanical harmony with the posterior inclined planes or with each other, excessive lateral overstress will develop.

In the course of grinding in this relationship, it is suggested that the grinding be confined to the area from centric contact to along the lingual surface of the upper teeth. If the portion of the lingual surface of the upper tooth that established contact in centric, or the lower tooth is ground, the teeth may be disoccluded in centric relation. At some future time, the lower tooth may move upward in centric and the original condition will have been established. By confining the grinding from the point of centric contact along the plane of the lingual surface of the upper tooth, ease of movement may be obtained without causing tripping in protrusive thrust and this will prevent the disocclusion of these teeth when they assume centric position (Figs. 11, 12, 13). (Note exceptions under centric.)

There are cases in which the incisal edges of both upper and lower anterior teeth have been ground in protrusive occlusion and a satisfactory relationship in this position is established. This has been done in cases in which one has reached the limit of grinding on the upper anterior teeth and is forced to grind the lowers or in conditions in which the lowers have been ground for esthetics. The result has been the development of a nonocclusion of these teeth in centric. This relationship in centric may continue for a long period in many instances, owing to the fact that the established protrusive position of these teeth may prevent the lower anterior teeth from gaining contact in centric. One must, however, be aware of the possible consequences should they again come into contact in centric.

Another exception occurs in severe cases of overbite when contact in centric is made between almost all the labial enamel surface of the lower with the lingual surface of the upper; it may be advisable to compromise. In this relationship, one can change the plane of the lower tooth by grinding from the lowest point of centric contact on the lower toward the incisal edge. In view of the fact that the *incisal edge* of the lower makes no contact with the lingual of the upper in this particular case, one can remove almost one eighth of an inch of tooth structure inciso-gingivally, if necessary, on the lower without interfering with centric occlusion, this relation having been established by the contact of the labial surface of the lower with the lingual surface of the upper. It is understood that the procedure is only followed in these cases of severe overbite. Occasionally beveling on the incisal edges of upper and lower teeth accomplishes a good protrusive occlusion without necessarily disoccluding the teeth in centric.

Often, too, in the extreme case of overbite the incisal edges of the lower teeth make contact with the lingual surface of the upper teeth. Even in these cases, the extreme overbite must be corrected. If grinding is the method that is decided upon, the operator must judge whether the upper teeth, lower anterior teeth, or both should be ground. The length of the anterior teeth and fundamental principles of occlusion will determine which anterior teeth are to be ground. An extreme overbite must cause overstress in the excursive movements of the mandible and unless corrected, serious periodontal disturbances will follow.

The esthetics should be observed as much as possible during the entire process of grinding, so long as it does not interfere with the proper functioning of the jaws. Occasionally, grinding for esthetic relation in one movement of the jaw may cause the development of nonocclusion in another excursion.

It is not necessary to procure posterior contact in natural dentures, if grinding will tend to make anterior teeth appear unsightly or make them extremely sensitive. Of course, the more teeth in contact during the pro-

*Many points in this article resulted from valuable suggestions made by Clyde H. Schuyler, D.D.S., Professor of Denture Prosthesis, New York University College of Dentistry, in discussions with him on the subject of traumatic occlusion.

trusive position, the more distribution of equalized stress will there be. It should be remembered, however, that we are not dealing with full dentures and there is no need for concern over a displacement of a full upper denture, through lack of posterior contact. For this reason, in some cases it may be advisable to distribute the stresses in such manner that only the central and lateral incisors are in simultaneous contact in the protrusive relation. When grinding in protrusive, to procure contact of the incisal edges of upper and lower anterior teeth, it is advisable to confine the grinding to the incisal edges of the upper teeth. If the incisal edges of the lower teeth are ground, non-occlusion in centric may occur. If grinding is confined to the incisal edges of the upper teeth, there will be no interference in the other excursions of the jaw. (Exceptions under protrusive and under centric.) Care must be taken to be certain that the patient is giving a true protrusive movement. The median line can act as a guide to the operator.

### The Lateral Movement

One must correct those abnormalities of wear that Nature has developed regardless of the cause. If possible, it is advisable to procure contact on working and balancing sides. However, the balancing side in some instances cannot be procured.

The cusps that had maintained contact with opposing tooth surfaces in centric position should also maintain contact in lateral movements of the jaw. The mastication of food depends on two factors: the sharpness of the cusps and inclines of the planes and the points of the cusps functioning on the inclines. Often in the process of correction, cusps are ground and their sharpness is removed, never restored, and the result is discomfort and inability to masticate food properly.

In this movement of the jaw, we think of the working and balancing sides. During the lateral movement of the jaw, the lower buccal cusps on the working side glide along the planes of the buccal cusps of the upper teeth in a scissors-like fashion; likewise the planes of the lower lingual cusps glide along the lingual cusps of the upper, no tripping, nor displacement of teeth taking place. Bucco-lingual movement should be procured without bucco-lingual stress. During this movement there should be contact of the teeth on the other side, called the balancing side. Should excessive stresses be noted, it may become necessary to reduce, and in some instances eliminate the inclined planes on the working sides.

The *modus operandi* for relief in

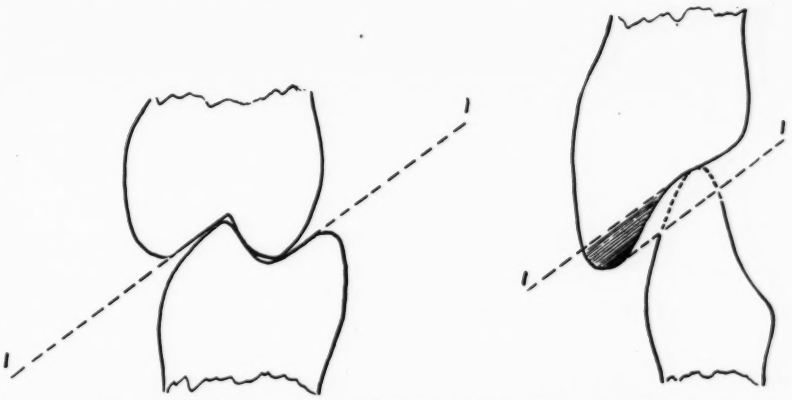

**Fig. 11—The planes of the posterior teeth should be in harmony, if not parallel to the lingual inclines of the upper anterior teeth. If these planes are not in harmony, added lateral stress is placed on the anterior teeth when the planes of these teeth are steep. The shaded area indicates the portion of the anterior teeth that should be ground to accomplish the desired result. (Courtesy of Doctor Clyde H. Schuyler.)**

**Fig. 12—Severe periodontal disease before treatment in a woman, aged 30. Note poor protrusive relation and venous congestion of tissue.**

**Fig. 13—Note change three months after completion of treatment. Note difference in protrusive relationship and also change in color.**

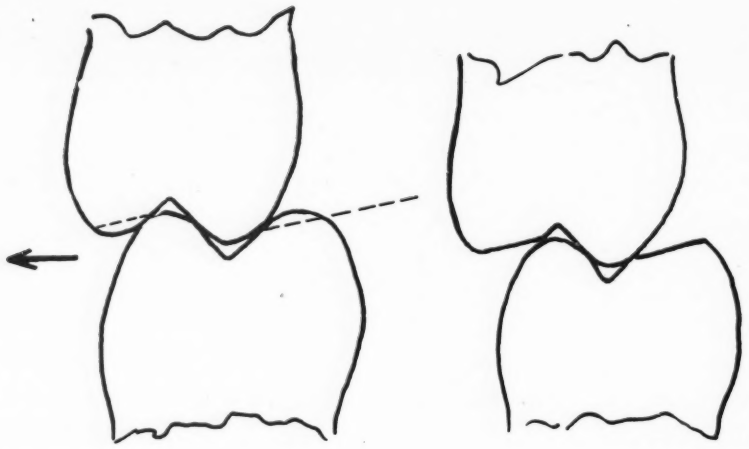

Fig. 14—How bicuspids and molars should be ground for excursive movements. Note that the centric relation has not been disturbed. (Courtesy of Doctor Clyde H. Schuyler.)

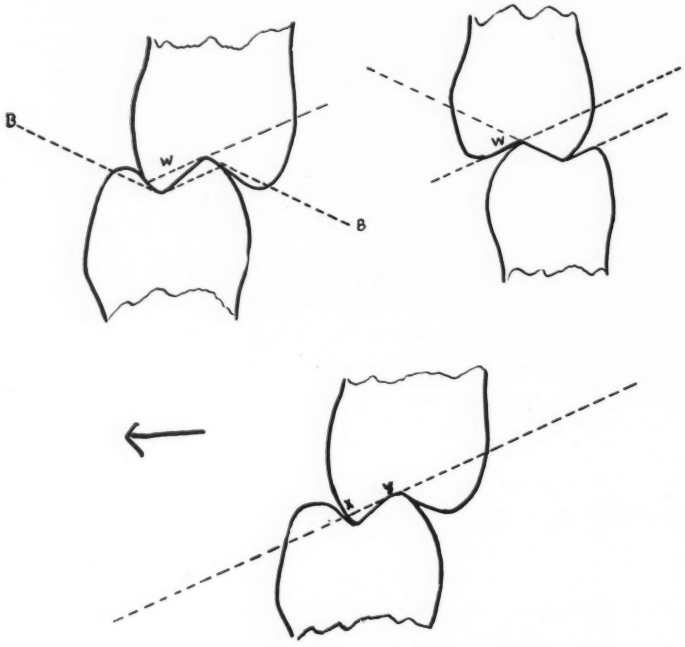


Fig. 15—A case in which compromise of grinding is considered, showing bicuspids and molars on one side. The molar is in cross-bite position. The flatter inclines of the bicuspids are chosen as the guiding inclines. Heretofore, in discussing teeth in normal relation, we have not suggested grinding the upper lingual cusp or lower buccal cusp. In this relation each of these cusps must be ground as shown in the line B—B in order to reduce premature contact in balance. The upper buccal cusp and the lower lingual cusp retain the maxillomandibular opening. The incline on either tooth parallel to W may be ground to reduce premature contact in function, but not on both. The lower picture indicates the reduction of one inclined plane. The grinding of both of these cusps takes the tooth out of function in the working excursions or permits closing of the bite. If both cusps of a natural tooth were ground it would place contact only on inclines B. This would be accompanied with closing of the bite or subsequent exfoliation of the teeth until contact is again restored. In either instance, the lower tooth would be wedged to the buccal and upper tooth to the lingual. The inclined plane X—Y is reduced to allow for proper movement. This cusp surface now harmonizes with the cusp surface W on the bicuspid. These conditions arise from time to time, and certain compromises must be made. (Courtesy of Doctor Clyde H. Schuyler.)

the lateral movements of the jaw is the same as in other positions; all means of determining excessive pressure; i.e., roentgenograms, palpation, ocular examination, study models, patient's response, are employed. With articulating paper as a guide, the patient is instructed to close the jaws in centric relation and then to move the jaws laterally. The tips of the fingers can be placed on the teeth on the working side to note whether any displacement takes place. The following procedure should be carried out:

1. The anterior teeth may be engaged during this movement. They should be relieved by grinding along the planes of the upper anterior teeth, so that centric will not be disturbed.

2. The cuspids often interfere during the lateral movement of the jaw, thus preventing contact with other teeth on the working side. The cuspids should be in contact throughout centric and eccentric positions. In the event that the cuspid interferes with correct lateral excursions, it should be ground from the point of centric contact along the path of the upper tooth. Should the lower cuspid be ground, it would take the lower cuspid out of contact in centric and will not again be in contact until the extreme excursive movement is reached. An overload is also placed on the remaining teeth in the arch. If the lower cuspid is ground it may exfoliate at some future time until contact in centric relation is again established, and thus reestablish the original premature contact in lateral movement.

3. The lower teeth now glide along the planes of the cuspid, bicuspid, and molar teeth with ease, with no tripping in the excursive movement. If during this lateral movement, it should be found that a tooth moves in its socket beyond what is considered normal, the presence of traumatic occlusion may be considered established. The traumatized teeth can be located, the articulating paper acting as a guide. The planes of the upper teeth are ground from the point of contact in centric along the buccal inclines of these teeth (Fig. 14). The surfaces of the teeth causing this undue pressure are relieved until they no longer interfere with the lateral movement. Teeth should glide over one another as do the blades of shears during the act of cutting. Under unusual conditions it is sometimes necessary to make certain compromises in grinding (Fig. 15).

4. Often the lingual cusps interfere, and it is essential to confine grinding to the planes of the lingual cusps of lowers rather than the cusp of the upper. Grinding the cusp of

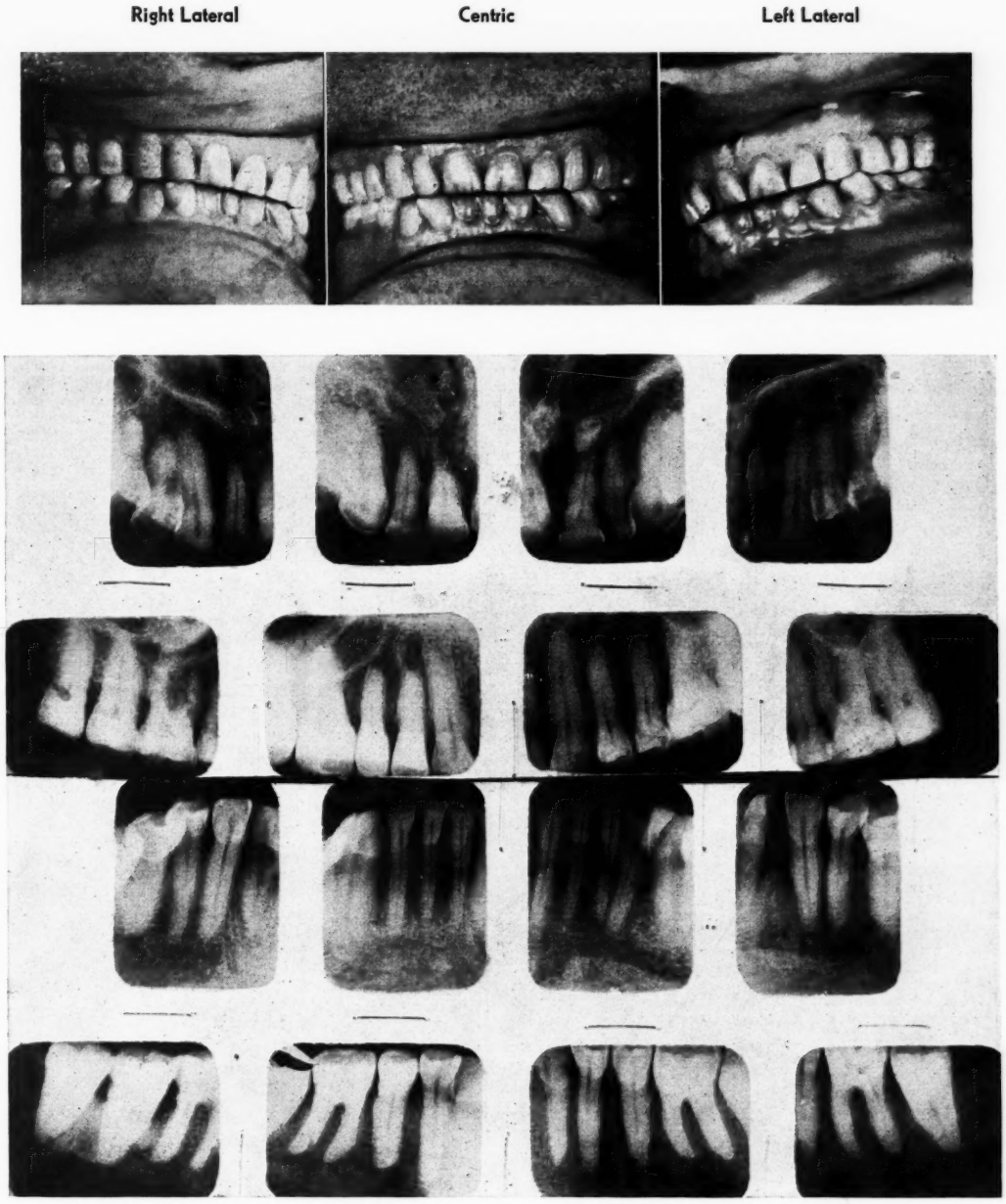


**Fig. 16—A man, aged 54, who ground in his occlusion through natural means.**

the upper would interfere with centric occlusion, because of the fact that in centric occlusion the cusps of the upper posterior teeth and the buccal cusps of the lowers rest in the central fossae of the opposing teeth.

5. The balancing sides must also be taken into consideration when the lateral excursions are considered. Here, two considerations determine the procedure: (a) The health of the teeth on the working side. If the teeth on the working side are loose, it becomes imperative to procure contact on the balancing side in order to relieve the strain of the loose teeth on the working side. (b) Should the teeth on the working side be strong and in good relation, and should further grinding to procure balance on the balancing side tend to imperil the form, sharpness, or sensitiveness of the teeth on the working side, it is advisable to leave well enough alone. After all, we need not fear the displacement of the denture as in full dentures. This lack of balance will cause a disturbance in equilibrium and a failure of the artificial denture to function well, whereas in natural teeth, this concern is not necessary. However, the more teeth in contact, the better the distribution of forces.

6. Often more pressure is felt on the balancing side than on the working side, and here is a problem that is rather serious. The contact on the balancing side is made by the gliding of the inclined plane of the buccal cusp of the lower tooth along the lingual cusp of the upper tooth. Fortunately, in most instances, it is the disto-buccal groove of the lower that makes contact. Should the lingual cusp of the upper be ground, then nonocclusion will result in the centric position and thus place a greater burden on the remaining portion of the tooth. By widening the disto-buccal groove on the lower tooth, the excess pressure can be relieved without caus-

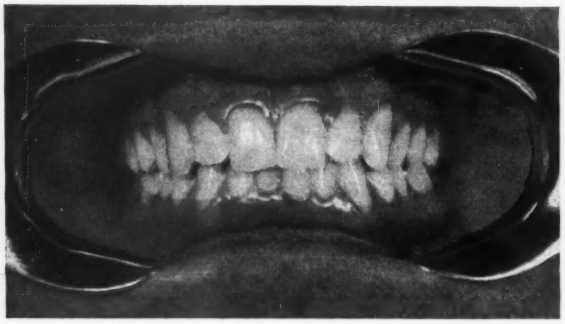

Fig. 17—Centric occlusion before grinding.

Fig. 18—Centric occlusion after grinding. Note improvement in esthetics.

Fig. 19—Left working side before grinding. Note that the upper left central, lateral, cuspid, and first bicuspid are engaged. No other teeth in the mouth are in contact during this movement.

Fig. 20—Left working side after grinding. Central and lateral are free, and the cuspid, both bicuspids, and first molar are in contact.

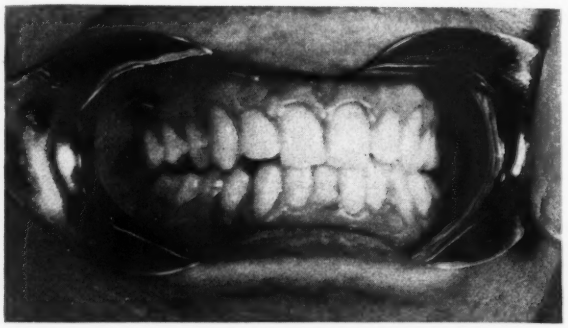

Fig. 21—Balancing side when the mandible is moved to the left, before grinding. Note that no teeth on the balancing side are in contact.

Fig. 22—Same case as shown in Fig. 21 after grinding. Note that the buccal cusps of the lower posterior teeth are in contact with lingual planes of upper.

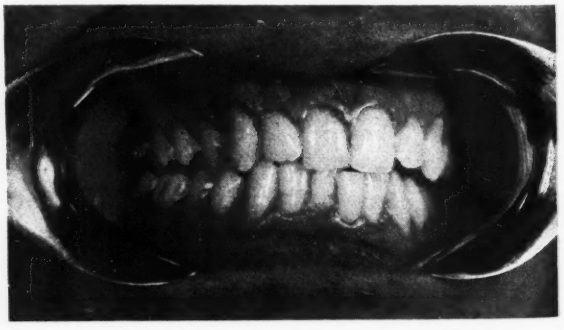

Fig. 23—Right working side before grinding. Note that the upper cuspid is the only tooth in contact.

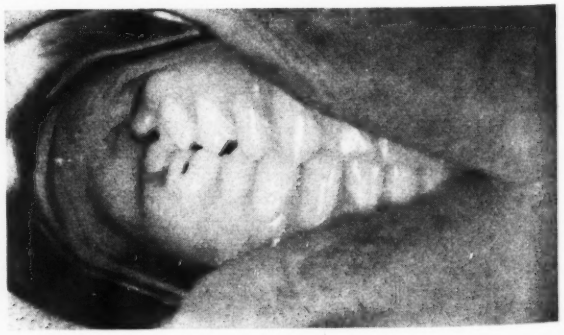

Fig. 24—After grinding. Note that the cuspid, bicuspids, and molars are now in contact.

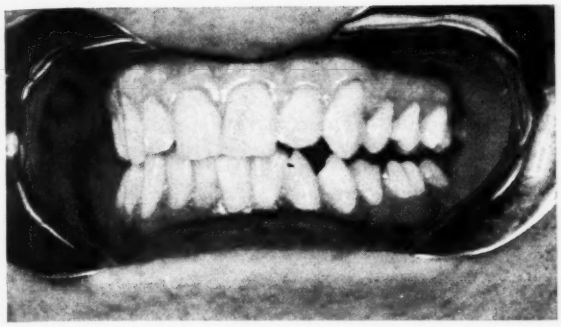

Fig. 25—Balancing side when the mandible is moved to the right. Note lack of contact.

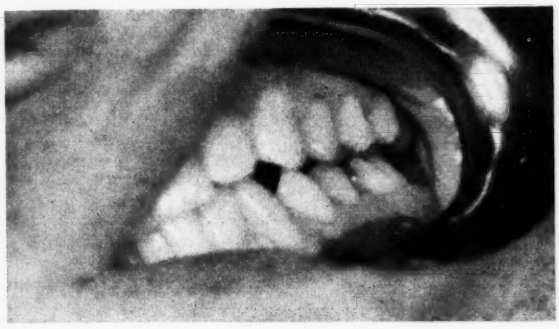

Fig. 26—Note case after grinding. There is contact now on the balancing side.

Fig. 27

Fig. 27—Note recession and festoons about upper and lower cuspids and first bicuspid. These conditions were due to excessive pressure in the lateral excursions of the jaw, these teeth being the only teeth in contact on the working side.

Fig. 28

Fig. 28—Same case, left side. On the left side, the lateral incisors and cuspids were engaged in the lateral excursions. (Photographs taken in protrusive relation.)

Fig. 29—Note inflammation on lower right cuspid and first bicuspid. These teeth were in traumatogenic occlusion in right working position.

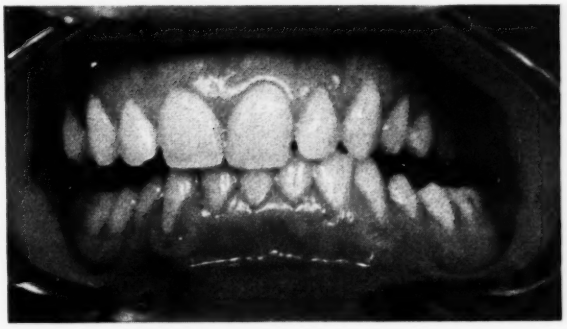

Fig. 30—Note recession on upper left cuspid and lower left cuspid; also lower left lateral. These teeth were in abnormal relationship in lateral excursion of the jaw as illustration indicates.

ing an upset of the centric relation. Should this relationship not exist, the models should be carefully examined and grinding should be confined to the portion of the teeth that would least interfere with centric relation.

The so-called balance in the lateral movements of the jaw should when completed give a normal contact on the working sides and balanced occlusion on the balancing sides. Tripping by the cusps in the oscillating movements of the jaw has caused good bridgework to loosen. This excessive pressure has produced mobility in otherwise healthy teeth.

## Final Check-Up

After all grinding has been completed, it is necessary to check back in order to determine whether coordination is present. When harmony in these movements has been obtained, and the minimum of tooth displacement has resulted, the coordination of the occlusion and equal distribution of stresses may be considered established (Figs. 16 through 30).

## Conclusion

The method of correction of traumatic occlusion that has just been described is suggested as a means of procuring equal distribution of stress-

es on natural teeth. The thought in presenting the subject is to outline fundamental principles that govern the procedure of grinding. However, all suggestions given for the relief of traumatic occlusion are not followed in every instance. The amount of grinding must be determined by the individual operator. The attainment of the ideal cannot be procured in all periodontal conditions as each case presents its own particular problems. Common sense should always be the guide. A number of additional suggestions perhaps will be helpful:

1. The case should be charted carefully. One should be certain that the diagnosis and prognosis are correct; that the roentgenograms are interpreted correctly, and that treatment is instituted only in those cases that will respond to treatment.

2. Grinding should be done slowly, and the stone should not be heated.

3. The form of the tooth should always be kept in mind during the process of grinding. The teeth should be polished with smooth cuttle-fish discs. To remove high spots or rough surfaces after grinding, one may incorporate carborundum paste into softened chewing gum. This method should only be used for a few minutes while the patient is in the chair under the immediate supervision of the dentist. *This should be employed only for smoothing surfaces, and not for reducing premature contacts.*

4. When the form of the tooth or density of the tooth structure or an artificial substitute does not allow for grinding, the opposing tooth should be used. However, when this is done, the operator must be acquainted with the possible consequences. If the offending member is grossly out of harmony, it may be necessary to extract the tooth, or in the case of a restoration to replace it. If crowns or bridges interfere, they should be removed and new ones placed.

5. If a sensitive area is encountered either during grinding or through erosions, 40 per cent formalin may be rubbed in by means of an orangewood point. A saturated solution of potassium carbonate in glycerin can also be applied to sensitive teeth. (200 grains of potassium carbonate dissolved in one ounce of glycerin makes a saturated solution.)

6. When patients complain of sensitiveness, or when they find difficulty during the relief of traumatic occlusion to cooperate further in the movement of the mandible, grinding should be discontinued. Fatigue often disturbs the patient's ability to follow instructions in the excursive movements of the mandible.

7. During the grinding process, a finger of the left hand is placed on the tooth. This added support to the tooth that is being ground, lessens the vibrations of the stone and gives more comfort to the patient.

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## ERRATUM

**On page 172 of the May, 1934, issue of THE DENTAL DIGEST, the legend under Fig. 7 should read "Loss of bone resulting from vertical and horizontal overstress," instead of "Loss of blood." (Sorrin, Sidney: Traumatic Occlusion: Its Detection and Correction, first installment.)**

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## A SIMPLIFIED METHOD OF TAKING THE BITE

IN THE usual way of taking the bite the patient sits in the chair and is below the horizontal vision of the dentist; hence he must look up to the dentist; this throws a tension on the trapezius muscle which in turn exerts tension on the hyoid muscles; this tension has a tendency to cause the patient to protrude his lower jaw. When the patient returns for the try-in the teeth often have to be reset; even then it makes a makeshift restoration unless a new bite is taken. And there is always the danger that the same faulty result may take place even if a new bite is taken. My method is simple and the results are always satisfactory; it seems impossible to get the bite wrong.

The bite plate is made ready to put in the patient's mouth. The patient is told to stand and look down at the floor a few feet away. He is then told to close his jaws while looking at the floor.

The closure will be correct every time. From then on the usual procedure is followed, for the only problem to practically all dentists is to get the correct bite.

After the denture is finished the patient may return with an abraded area caused by the edge of the plate cutting the mucoperiosteum. This is usually due to the fact that one of the teeth is too high. If the tooth is too high no amount of cutting the plate will relieve this condition. Carbon paper must be used. When the patient sits in the chair with the plates in place and is told to bite on the carbon paper he will nearly always protrude with the lower jaw. The patient should be told to stand and while looking down at the floor the carbon paper should be inserted; he will then bite in the correct position. The high spots can be ground off accurately.

—GEORGE E. COX, D.D.S., *Wilmington, Delaware.*

# The Editor's Page

CONSIDERABLE controversy prevails concerning the application of the insurance principle to the several phases of medical care. The advocates of a national system of sickness insurance maintain that through sickness insurance persons in the low income groups will receive more adequate care, and that the "producers" of medical care will be better rewarded than under an individualistic system of distribution. On the other hand, the opponents of the insurance system insist that the type of medical care under sickness insurance is inferior and that the "producers" are not only poorly rewarded but are dominated by lay managers. Between the utopia of the proponents and the chaos of the opponents there is likely to be a meeting ground wherein both the recipients and the producers of medical care may prosper.

No good end will be served by the dental profession if it accepts either the enthusiasms of the proponents or the calamitous prophecies of the opponents. Dental societies that are contemplating independent studies of the principles of health insurance will do well to appoint men to such committees who have the capacity for judicial and unprejudiced thinking; preferably men who are neither for nor against the principle of health insurance. Both the rabid advocates and the vigorous opponents of the insurance principle have their minds rigid to arguments and new ideas. Such men on committees will prosecute their own preconceptions and will use the committee meetings as sounding boards to advance their particular theories. The qualifications for membership on such a committee should include a clear mind, a judicial temperament, an appreciation of the scientific method, and a freedom from "ready made" thought. Given the will and the capacity to learn a committeeman need know nothing about sickness insurance when the committee begins the study. A man free from the trammels of preconceptions will be of greater value than either the over-zealous advocates or bigoted opponents of the insurance principle.

Committees that approach the study of sickness insurance have a task, a responsibility, and an opportunity. They should start, not with the idea of formulating a plan of insurance or of a system of distribution of medical care, but with an historical study of the insurance principle as applied to medical care. Once grounded in the historical facts gathered from reliable sources, they will be ready to proceed with an analysis of the strong and the weak points in the existing European systems. They must be prepared to evaluate insurance as it affects both the patient and the dentist. If the patient benefits under insurance and the dentist suffers, there is something wrong with the system; if the patient receives poor care and the dentist prospers, there is likewise something wrong with the system. If under insurance there is an increase in medication, superficial examinations, hasty treatments, the development of the neuroses of "flight into sickness" and "sickness advantage," there is something wrong in the system. If, in the other case, morbidity and mortality are decreased among the working classes, there is something in the system that suggests a social good.

The present status of national sickness insurance systems in several leading European countries is suggested by these facts. In *Great Britain* the system was established in 1911 and modified in 1924. Less than half of the total population of forty-four million is included in insurance, either compulsory or voluntary. One hundred and sixty million dollars are spent annually for insurance. In *Germany* the system dates from 1883. Sixty-three per cent of the population are beneficiaries under insurance, and three hundred million dollars are spent annually. In *France* the law was enacted in 1930. Twenty-nine per cent of the population are eligible to sickness insurance benefits. In *England* satisfaction for the system is expressed by both the insured and physicians; in *France* by the physicians and not by the beneficiaries; in *Germany* by neither *party*.[1]

We have learned through our experiences in working with relief administrators in supplying dental care to the indigent that the lay administrator is only seldom one who understands professional values. He is experienced in buying bread, coal, and shelter, and not in buying professional services. The haggling, chaffering voice of the market square has no place in the purchasing of medical care under insurance or any other system.

1 J. A. M. A. 102:1615 (May 12) 1934.

# WHY DENTAL CARIES WITH MODERN CIVILIZATIONS?

## X. FIELD STUDIES AMONG PRIMITIVE AND MODERNIZED ESKIMOS OF ALASKA

WESTON A. PRICE, D.D.S., M.S., F.A.C.D.

Cleveland

AMONG all modern civilization's cherished heritages the North American Eskimo stands as a guiding beacon. The Maya race is gone but has left its monuments. The Indian race is rapidly disappearing. The Eskimo race has remained true to ancestral type to give us a living demonstration of what Nature can do in the building of a stalwart people competent to withstand for thousands of years the rigors of the Arctic climate. Doctor Alex Hrdlicha, Curator, Division of Anthropology of the Smithsonian Institution, Washington, refers to the Alaska Eskimo as a remnant of the Stone Age people, for they live very much as they did ten thousand years ago. Like the Indian the Eskimo has thrived as long as he was not blighted by the touch of modern civilization but with it like all primitives, he degenerates. We are concerned to know the reasons for this. In his primitive state he has provided an example of physical excellence and dental perfection seldom equaled by any race of the past or present. We are concerned to know the secret of this achievement since his circumscribed life reduces the factors that may enter as controlling units in molding this excellence. While we are primarily concerned in this study with the characteristics of the Eskimo's dentition and the effect on it of his contact with modern civilization, we are also deeply concerned to know the formula of his nutrition in order that we may learn from it secrets what will aid not only the unfortunate moderns or so-called civilized races but also if possible provide means for assisting in his own preservation.

It is a sad commentary that with the intrusion of the white man the Eskimos and Indians are being rapidly reduced by the white man's diseases. We have few problems more urgent or more challenging than that means shall be found early for preventing the extermination of these sturdy primitive Americans.

Many reports have been made with regard to the condition of the teeth of the Eskimos. Doubtless all have been relatively authentic for the groups already studied, which have been chiefly along the routes of commerce. Clearly those people would not represent the most primitive groups. The primitive groups could only be located beyond the reach of contact with modern civilization. The problems involved strongly suggested the desirability of locating and studying Eskimos in isolated districts. While dog teams could furnish means of approach in the winter season, they could not be available for summer travel.

Through the kindness of Doctor Hrdlicha who has made anthropologic studies of the Eskimos in many of the districts of Alaska, I learned that the most primitive groups were located south of the Yukon in the country between it and Bristol Bay including the delta and the mouth of the Kuskokwim River. Accordingly, our program for making field studies among these people required transportation over long distances and into districts where traveling facilities were practically nonexistent by other means than the modern airplane. The itinerary, therefore, included steamship service to Seward in western Alaska and railway to Anchorage where an airplane was chartered which carried us to various districts in western and central Alaska. The great Alaska Range culminating in the magnificent Mt. McKinley stretches across Alaska from the Aleutian Peninsula at the southwest far into the heart of this vast territory. It was necessary for us to cross this range to reach the territory in which our investigations were to be made. Herds of mountain goat seemed to be interested in the strange bird that was flying so near them. Beyond these mountains vast areas of bare wilderness were flown over where there were no signs of human life. Moose were frequently seen.

Our first objective was to find, if possible, a band of Indians reported to live on Stoney River. They had been described as being primitive. Our pilot who was one of the best informed men about this territory because of his large flying experience in Alaska said that this was the first time he had even landed in this district. All the people were busy catching and storing the running salmon. After the fish were dried they were smoked for a few hours and then stored for winter use. These thrifty people have physical features unlike the Indians of central, southern, and eastern Alaska. Of the twelve persons studied here ten had lived entirely or practically on native foods. Of their 288 teeth only one tooth was found that had ever been attacked by tooth decay or 0.3 per cent. Two had come up from the Kuskokwim River, of which Stoney River is a branch, where they had received a considerable quantity of the "store grub" which had been shipped up the Kuskokwim from Bethel. Of these, 27 per cent of their teeth had been attacked by dental caries.

We then proceeded to Sleet Mute, on the Kuskokwim River, where three persons were found who had lived entirely on native foods and had never had a single tooth attacked by tooth decay. Seven others had lived partly on native foods and partly on "store grub," and they had dental caries in 12.2 per cent of their teeth.

At Crooked Creek, the next settlement, eight persons were examined and of their 216 teeth, forty-one had caries or 18.9 per cent. All but one of these persons were living in considerable part on "store grub" and this one had no dental caries.

At Napimute, 16 per cent of the teeth had been attacked by dental caries and none of the persons studied here was living entirely on native foods.

Bethel is the largest settlement on the Kuskokwim and contains in addition to the residents many visiting Eskimos from the tundra country surrounding it. Eighty-eight persons studied here were largely Eskimos and mixed bloods. Of their 2490 teeth 11.6 per cent or 281 teeth had been attacked by tooth decay. Of these eighty-eight persons twenty-seven with 796 teeth had lived almost exclusively on natural foods and in this group only one tooth was found with dental caries or 0.1 per cent. Forty persons were living almost exclusively on modern foods as shipped in by the government supply boat which comes once a year. Of their 1094 teeth 252 or 21.1 per cent had been attacked by tooth decay. Twenty-one persons were living

partly on native foods and partly on "store grub" and of their 600 teeth thirty-eight had been attacked by tooth decay or 6.3 per cent.

At Kokamute on the Bering Sea at the mouth of the Kuskokwim River, a large band of primitive Eskimos was studied. They had come from the vicinity of Nelson Island which is a district with little contact with modern civilization. In this group twenty-eight persons with 208 teeth showed only one tooth that had ever been attacked by dental caries or 0.1 per cent.

Bethel Island is situated in the Kuskokwim River. It is visited in the summer by Eskimos from the tundra country for laying in their store of fish for winter use. Of fifteen persons studied here thirteen with 410 teeth had lived exclusively on native foods and not a single tooth had been attacked by dental caries. Two had come from Bethel and of their sixty teeth twenty-one or 35 per cent had been attacked by tooth decay.

In the various groups in the lower Kuskokwim seventy-two persons who were living exclusively on native foods had in their 2138 teeth only two teeth that had ever been attacked by tooth decay or 0.9 per cent. In this district eighty-one were studied who had been living in some part or in considerable part on modern foods and of their 2254 teeth 394 had been attacked by dental caries or 13 per cent. This represents an increase in dental caries of 144-fold.

**Fig. 1—This full-blooded Eskimo woman is the wife of a mining engineer and has insisted on living largely on her native foods. She is the mother of twenty children, and has no tooth decay. A lower incisor is broken. The teeth show marked wear. Note the breadth of both dental arches.**

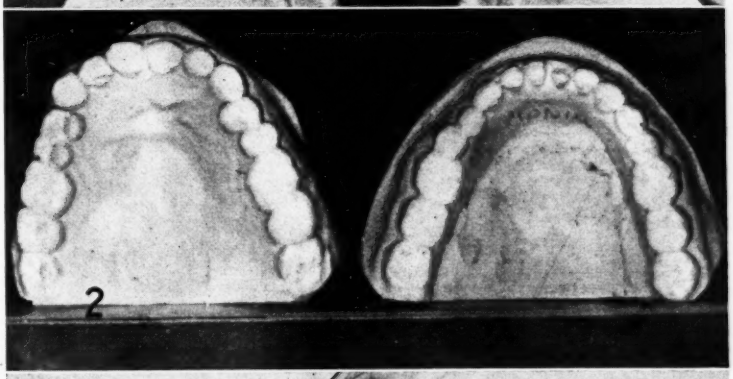

**Fig. 2—These models of the dental arches of the woman shown in Fig. 1 show the splendid development of the supporting structures, and normal contours and arrangement of the teeth.**

**Fig. 3—Teeth of both the older men and women of the full-blooded Eskimos show a great deal of wear, but they are free from dental caries.**

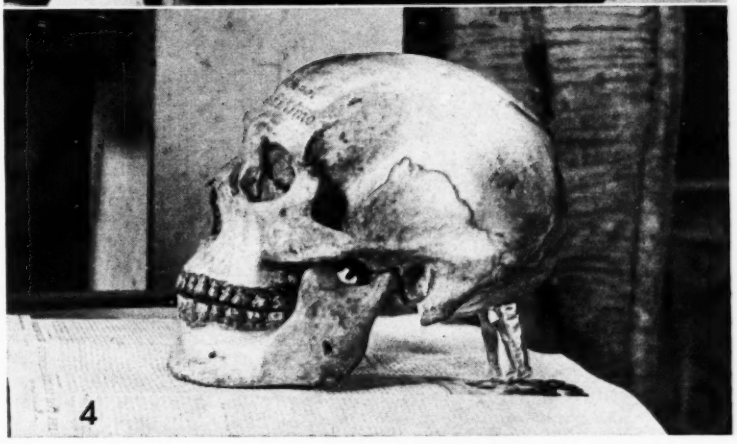

**Fig. 4—There is a remarkable similarity in the skulls of modern Eskimos and those of earlier periods. All are remarkably free from dental caries and evidence of pyorrhea or gingival infections. This museum specimen is prehistoric.**

It next became desirable to study a district that had been in contact with the foods of modern commerce for many years and for this, Holy Cross was selected. This community is located on the Yukon River. It has been in contact with the summer commerce of the Yukon River for several decades. It has one of the oldest and best organized Catholic Missions of Alaska. Those studied were all in the school connected with the Mission. The students had come from as far north as Point Barrow on the Arctic Ocean and west to the Bering Straits. All but one had used modern foods before coming to the Mission and were using them while there. The one exception had lived exclusively on native foods before coming to the Mission and he had no teeth attacked by dental caries. Eight persons, with 224 teeth, who had lived largely on modern foods had forty-two teeth that had been attacked by tooth decay, or 18.7 per cent. Four persons had lived partly on native foods and partly on modern foods, and of their 112 teeth four had been attacked by tooth decay, or 3.5 per cent.

It is of interest that while the Eskimos and Indians have lived in splendid accord they have mixed but little. The Eskimos occupy the lower section of the Yukon and Kuskokwim Rivers and the Bering Sea frontier. The Indians have occupied the upper waterways of both these rivers. The next place selected for study was McGrath which is on the upper Kuskokwim not far from the McKinley Mountain Range. It is the upper terminus of navigation on the Kuskokwim River by the small stern-wheel river boats. It has its chief importance at this time in being the division point of the Cross Alaska Airplane Routes from Anchorage or Fairbanks to Nome and other western points. Its population consists of several white prospectors and miners who remained in the country following the Gold Rush. Some of them have married Indian and Eskimo women. Of twenty-one persons only one had lived almost exclusively on native foods and she had no dental caries. Twenty had lived chiefly on imported foods, and of their 527 teeth 175 had been attacked by tooth decay or 33.2 per cent.

Among the residents of McGrath there is a remarkable family. The father is an American engineer who has spent much of his life in that country. His wife is a charming Eskimo woman of intelligence and fine personality. She had come originally from the lower Kuskokwim and was one of the primitive Eskimo stock. While the mining interests had provided food supplies for the family which were shipped from the United States she followed her early training and insisted on catching and storing salmon in season as an important part of her dietary. She was the mother of twenty children. Only eleven were living, however, the others having died from tuberculosis. Notwithstanding her many pregnancies not a single tooth had ever been attacked by tooth decay. A lower anterior tooth had been broken. A picture of this woman is shown in Fig. 1 and a picture of the models of her dental arches is shown in Fig. 2. It will be noted there has been excessive wear as is characteristic of so many of the Eskimos, a matter that we will presently discuss. It is of interest to note the splendid symmetry of her dental arches. Her children and husband and son-in-law had lived largely on modern foods, and in eight persons with 212 teeth eighty-seven teeth had been attacked by tooth decay, or 41 per cent.

One does not get a conception of the unusually fine dental development of the more primitive Eskimos simply by learning that they have freedom from dental caries. The size and strength of the mandible, the breadth of the face, and the strength of the muscles of mastication—all reach a

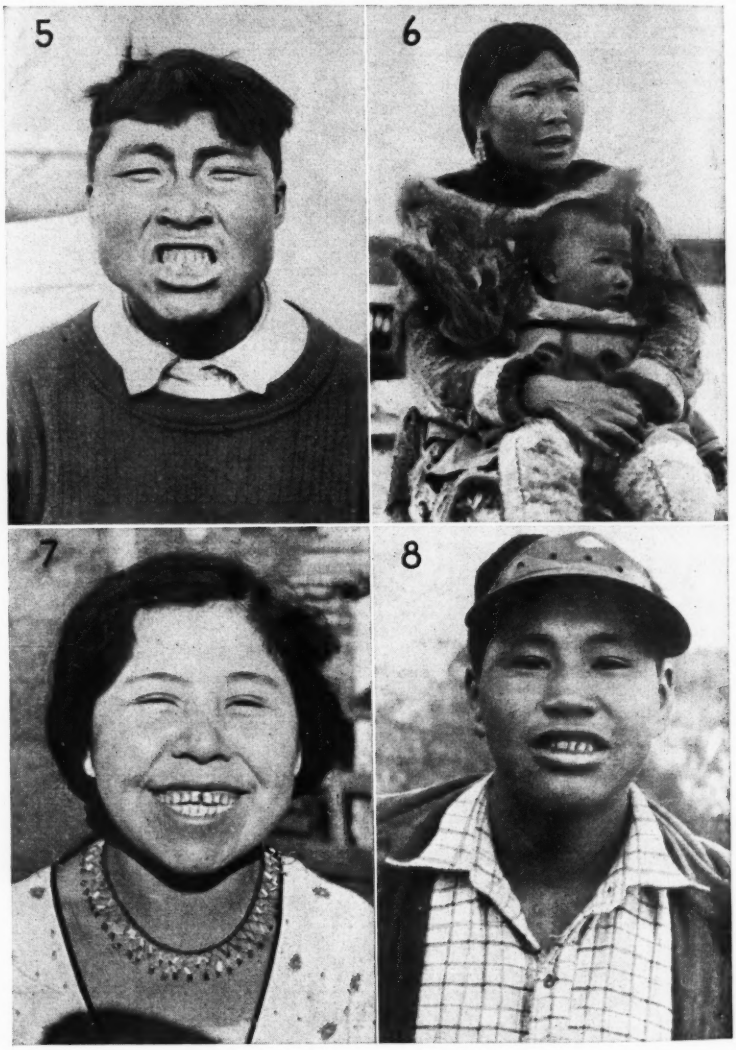


**Fig. 5—A typical full-blooded Eskimo raised on sea foods. Note the splendid mandibular and muscular development.**

**Fig. 6—Furs are worn the year round by many of the Eskimos in western Alaska. They are decorated with different colored furs, often artistically designed. Even the children may be dressed in them in the summer. Note the width of the dental arches of this mother.**

**Fig. 7—Modernization rapidly destroys the beauty through the loss of the teeth. The pulps in the carious centrals of this otherwise comely girl are both putrescent.**

**Fig. 8—This modernized Eskimo boy has seventeen of his teeth attacked by dental caries. The left central and lateral have pulp involvement.**

degree of excellence that is seldom seen in other races. This is typically illustrated in Fig. 5. I was told that an average adult Eskimo man can carry a hundred pounds in each hand and a hundred pounds in his teeth with ease for a considerable distance. This illustrates the physical development of other parts of the body as well as the jaws and suggests that the problem of exercise of the jaws is not the sole reason for their good teeth as has been frequently suggested. It has also been suggested that their chewing of tough foods has been an important factor in the establishment of immunity to caries by building teeth of exceptionally fine quality. The teeth of these people with their excellent physical development and fine tooth structure develop caries when they depart from their native foods and use our modern foods, as will presently be shown.

Much has been reported in the literature of the excessive wear of their teeth which in the case of the women has frequently been ascribed to the chewing of the leather in the process of tanning. In Fig. 3 will be seen an elderly Eskimo whose upper teeth are worn nearly to the gum line. It is of interest that while many mouths were studied with excessive wear of the teeth involving the crowns to a depth that in many persons would have exposed the pulps, there was not seen in any of these cases an open pulp chamber. They were always filled in with secondary dentine. This is important inasmuch as our newer knowledge indicates that the chemical characteristics of their food would lead us to expect that secondary dentine would be readily formed within the pulp chambers by a process similar to that which I have demonstrated as occurring in many persons under a program in which their diet had been reinforced with mineral and activator providing foods. It will be noted that this Eskimo in Fig. 3 has a scar on his lower lip which is the result of perforations for carrying a decoration according to the practice of his tribe.

Owing to the cold winds off the Bering Sea even in the summer many of the women wear furs. A typical mother and child dressed in their warmer clothing are shown in Fig. 6. This Eskimo mother's teeth are literally "two rows of pearls." It is important to note the width of the arches. One is continually impressed with the health of the childlife. It is of interest that we never heard an Eskimo child crying in our various contacts with them except when it was hungry or frightened because of the presence of strangers. It is characteristic of Eskimo women that they have an abundance of breast milk. The milk practically always develops normally and is maintained without difficulty for a year. This mother shown in Fig. 6 had had complete freedom from dental caries and I was told that the children of the Eskimos have no difficulty in cutting their teeth.

This excellence of dentitions among the Eskimos has been a characteristic of the skulls that have been excavated in various parts of Alaska. A typical prehistoric specimen is shown in Fig. 4 which I photographed in the museum at Sitka. These teeth show wear as do the teeth of moderns but none had been attacked by dental caries. Note the splendid structure of the supporting bone. The normal contours of the interdental septa give evidence of freedom from gingival infection or pyorrhea.

It might be expected that teeth so well formed would maintain so high an immunity to dental caries that their proud possessors would never be troubled with that disease. This, unfortunately, is not the case, which is significant and important in evaluating our modern theories of dental caries. When these adult Eskimos change their foods for our modern foods, they often have rampant tooth decay and suffer severely. A typical effect of modernization on a growing girl is shown in Fig. 7 in which the central incisors are seen to be attacked by dental caries as are eighteen of her teeth.

Degenerations that are the result of modernization are readily shown in the face and in the teeth of the boy seen in Fig. 8. He was living in a community that was obtaining modern foods, and seventeen of his teeth had been attacked by dental caries. There are no dentists in western Alaska, north or west of Anchorage which is near the southern coast, except at Fairbanks which like Anchorage is many hundreds of miles from these Eskimos whom we have been studying. It would take months for them to make the journey in winter by dog team and it would be practically impossible in summer by any means of travel except airplane which, of course, they could not afford. Their dilemma is accordingly tragic when they suddenly become victims of diseases which require hospitalization or skilled medical or dental service. One mining engineer in the interior told me that he had spent two thousand dollars to have a dentist brought in by airplane to render dental service. On my examination of his mouth I found that twenty-nine of his thirty-two teeth had been attacked by dental caries.

As we will see in our next communication this stalwart race is rapidly dying out wherever it is in contact with modern civilization. If the scroll could be scanned for the span of their existence we would find them living wholesome carefree lives always with an abundance of food and abundance of health until the time when the blight of modernization came on them and they then rapidly began to disappear. It is doubtful if any sadder commentary will ever be written concerning our misguided craze for foods that are highly satisfying because they are high in energy and easily eaten. We have thought because they satisfy our hunger they were adequate. How strange that in our ignorance we have not before inquired the way from these experienced primitive people.

In our next communication, the last of this series, we will study some other expressions of faulty nutrition, some of which are disturbances in physical development and injuries to the chemical mechanism that provides the defensives with which we fight infections and build and repair tissues. We will also study the chemical characteristics of the foods which were eaten by the people with high defense to dental caries and which produced their fine physiques. Similarly we will study the chemical nature of the foods that have supplanted their native foods with the resulting physical and dental degeneration. We will make application as space permits of these data to our current modern nutritional problems that are cursing all modern civilizations.

(*End of Tenth Installment*)

*COMING*

XI. New Light on Loss of Immunity to Some Degenerative Processes Including Dental Caries.

Dental Research Laboratories
8926 Euclid Avenue.

# ELECTRIC PHENOMENA IN THE ORAL CAVITY*

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Oklahoma City

I HAVE previously[1] called attention to certain pathologic conditions in the oral cavity that could not be attributed to other than electrogalvanic phenomena between restorations of variable positions in the Electromotive Force Series of metals. The object of this communication is to report additional experiments, and to revise my former discussion, deducting such conclusions as I believe justified by a larger experience and study of this subject.

Sensitive electric tests reveal that there is an electric potentiality in every oral cavity between two or more metallic restorations that are composed of dissimilar elemental consistency. Solomon, Reinhard, and Goodale[2] have suggested that there may also exist a separate battery within or surrounding each metallic restoration.

There is no demonstrable electric current between any number of normal teeth, nor between those which contain nonmetallic restorations.

All metallic restorations are alloys of three or more metals. Some contain as many as five; hence, the complexity of the problem facing future metallurgic dentistry.

Human saliva is an excellent electrolyte, whether neutral, acid or alkaline, though the degree of variation from neutral increases the electric potentiality. Therefore, a mouth that contains metallic restorations of variable positions in the standard electromotive scale constitutes a complete galvanic battery.

A positive and simple experiment verifying this electric phenomenon in the mouth consists in placing a polished silver dime upon the dorsal surface of the tongue and a polished copper penny beneath the tongue where they are held for a few minutes, and their edges are slowly brought together over the end of the tongue. There is experienced at once a taste of copper which has been liberated from the penny, the negative pole in this instance. After a few minutes there may also be experienced a sensation of temperature or irritation produced at the point of the interrupted contact of metals.

### Symptoms

Many patients who have had metallic restorations immediately experience a metallic taste; some, an occasional electric shock when a table fork or spoon accidentally completes the circuit between their dissimilar metallic restorations.

Experienced dentists have found it necessary to grind short one metal restoration when placed in such a position that it contacts another of dissimilar consistency. Sensitive and tender teeth may also result from such galvanic batteries.

The symptoms of electrogalvanic phenomena are early manifested by a peculiar metallic or salty taste and an increased salivary secretion. The taste is commonly attributed to some acid, zinc, or copper content of the cement. Such symptoms soon become tolerated or forgotten, unless reminded by additional electric shocks from contacting restorations.

Many months or years later there may occur localized symptoms in the form of an irritable tongue, gingivitis, congested patches, erosions, ulcers or leukoplakia (grayish-white precancerous proliferation). Leukoplakia may develop without the patient being aware of its presence.

Highly sensitive persons may have constitutional symptoms, such as extreme nervousness and neurasthenia. Evidence of electrogalvanic action upon dentures consists of disintegrations, leaky margins, loosening and discolorations of restorations.

Traumatic or chemical irritants, such as rough, ill-fitting restorations, strong dentifrices, tobacco, or chronic infections may emphasize such oral cavity lesions.

Solomon and Reinhard[4] have also made a study of this phenomenon and discuss it as follows:

> The writers in a previous paper stressed the importance of local electrical action that can occur around any alloyed metallic restoration in the mouth. Attempt was made to call attention to physical and electrical laws which indicate that current may be generated in a single alloyed restoration and that it is entirely unnecessary to have two or more restorations.
>
> Both clinical and laboratory observations show that such electrical action does occur in alloyed oral restorations and may subsequently cause definite changes in the oral soft tissues as well as pulp 'shocks.' Its irritating effect can produce lesions of varying forms, among which are leukoplakia, burning or sting-

TABLE 1.—*Metals in Electromotive Force Series*[3]

| POSITIVE END | |
|---|---|
| Cesium | Cobalt |
| Rubidium | Nickel |
| Potassium | Tin |
| Sodium | Lead |
| Lithium | Hydrogen 0.0000 |
| Barium | Copper |
| Strontium | Arsenic |
| Calcium | Bismuth |
| Magnesium | Antimony |
| Aluminum | Mercury |
| Manganese | Silver |
| Zinc | Palladium |
| Chromium | Platinum |
| Cadmium | Gold |
| Iron | NEGATIVE END |

*From the Department of Dermatology and Radiotherapy, Oklahoma University School of Medicine, and Lain-Roland Clinic.

1Lain, E. S.: Electrogalvanic Lesions of the Oral Cavity Produced by Metallic Dentures, J. A. M. A. **100**:717 (March 11) 1933; Chemical and Electrolytic Lesions of the Mouth Caused by Artificial Dentures, Arch. Dermat. & Syph. **25**:21-31 (January) 1932.

2Solomon, H. A.; Reinhard, M. C., and Goodale, H. I.: The Possibility of Precancerous Oral Lesions From Electrical Causes, DENTAL DIGEST **39**:142 (April) 1933.

3Hodgen, J. D.: Practical Dental Metallurgy, ed. 7, St. Louis, C. V. Mosby Company, p. 49.

4Solomon H. A. and Reinhard, M. C.: Electric Phenomena From Dental Metals, Dental Survey **75**:23 (December) 1933.

ing tongue, gingivitis, and reddened, inflammatory areas of varying appearance. It is also to be remembered that any form of chronic irritation may be a factor in the production of cancerous lesions.

Observation shows that most mouths apparently tolerate such action without ill effect. In a practical interpretation of the relationship of galvanic action to the production of oral lesions, we must stress the scarcity of objective and subjective symptoms in view of the large number of restorations present in most mouths. However, it is well to bear in mind the possibility of galvanic stomatitis when confronted with a patient complaining of vague or obscure oral mucous membrane involvement that has exhausted the diagnostic encyclopedia.

Further experiments and study have led me to agree for the most part with the expressed conclusion of Solomon and Reinhard, though they do not appear to have evaluated time properly as an etiologic factor in the production of visible pathologic change.

I have recently studied the problem as to whether or not this electric energy is only a static potentiality waiting for an external connection to complete its circuit, or whether the current flow is continuous, which causes localized ionization or deposition of the positive metal (cataphoresis) into the soft tissue.

### Observations and Experiments

The degree of electric energy is dependent on many factors, such as the surface area of materials used in metallic restorations, resistance of tissue, connecting cords, contact points, and the internal resistance of the electric meter used for measurements. Of most importance is the relative position of the metallic restoration material in the Electromotive Force Series of metals.

The effects of electrochemical action on metallic restorations are easily recognized after a period of time by noting the polished appearance of the positive, and the dull appearance of the negative. This difference is due to the deposition of electropositive liberated ions upon the negative restoration.

It may be observed that amalgams containing a high percentage of silver, from 68 to 70 per cent, after a few months appear darker than their associate amalgams which may contain only from 40 to 50 per cent. The appearance of gold reconstructions may likewise indicate their percentage of alloy.

Silver is only three positions above gold in the standard scale of metals; hence, a high content of silver in association with the twenty-four karat gold rarely produces any appreciable symptoms of galvanic irritation.

Miller[5] and I with standard instruments (the Wheatstone Bridge, galvonometer, and microammeter) made multiple tests and experiments in order to determine the possible effects of heat, resistance, and direction of current flow. Determinations were first made outside the mouth of the resistance of fresh bone and muscular tissue of approximate equal surface area and weight. We found that bone offers a resistance (ohms) about eight times greater than muscular tissue.

The measurements inside the mouth revealed that resistance is sixty-nine times (ohms) greater between approximately equal distances through tooth enamel and maxillary bone structure than through buccal mucosa. Areas of the buccal mucosa offer a resistance (2300 ohms) more than twice the amount of a like distance tranversely through the tongue (950 ohms).

### Deductions and Conclusions

I have formerly conjectured that patches of leukoplakia caused by electrogalvanic irritation most frequently observed adjacent to the positive metallic restorations were perhaps largely due to heat and dehydration produced by the flow of electric current. Such localized patches of leukoplakia are common incidents upon the lips and buccal mucosa of smokers.

By using known standard physical electric equations we calculated the approximate units (calories) of heat generated in the tissue between various dissimilar restorations. We found such an infinitestimal fraction of calories of heat as to appear to be an unimportant etiologic factor in the production of leukoplakia.

It has been proved in cancer research laboratories that chronicity of the irritant is an etiologic factor of paramount importance; therefore, I am convinced that the unit measurement of current is of less importance than time or chronicity in the production of any kind of electrogalvanic oral cavity lesion.

Since gross lesions, more especially leukoplakia, usually occur upon the soft tissues adjacent to the positive metal, it appears reasonable to assume that this precancerous growth may be caused by chronic cellular stimulation from the current flow, plus the deposition of foreign metallic ion (cataphoresis) which have been liberated from the positive pole of this "human galvanic battery."

Recent tests made with so-called chrome metal, reconstructions and restorations, in association with gold and silver alloys, give some encouragement toward the solution of this problem, though it still offers an immediate challenge to the scientific skill of metallurgists and dental manufacturers.

Medical Arts Building.

5For valuable suggestions, recent laboratory experiments and mathematical determinations by the application of fundamental physical laws I am indebted to Louis L. Miller, M. A., Head of Department of Physics, North Texas Teachers College, Denton, Texas. For many cases which were studied before and after change of restorations, for valuable suggestions, and the construction of numerous models for experiments and exhibits, I am indebted to G. Sherrill Caughron, D.D.S. and Jack R. Caughron, D.D.S., Oklahoma City.

## ABOUT OUR CONTRIBUTORS

Warren Willman, B.S. (Loyola University, 1926), D.D.S. (Chicago College of Dental Surgery, 1927). Doctor Willman has previously contributed to the dental periodical literature. He is a member of the A. D. A., Chicago Dental Society, Illinois Dental Society, and the Odontographic Society. Doctor Willman has been teaching for seven years (periodontia and operative dentistry) at the Chicago College of Dental Surgery where he has also conducted his research work.

Sidney Sorrin, D.D.S., has on a previous occasion contributed to The Digest. His article Periodontal Disease: Diagnosis and Treatment appeared in two installments in the November and December, 1932, issues of The Dental Digest, and his professional biography appeared in the November number of that year.

The biography for Weston A. Price, D.D.S., M.S., F.A.C.D., appeared in a previous issue of The Dental Digest.

The professional biography of Doctor C. L. Meistroff appeared in the December, 1933, number of The Dental Digest, in conjunction with his article *A Simplified Technique for the Removal of Apexes and Retained Roots.*

Everett S. Lain was graduated from Vanderbilt University in 1900 with an M.D. degree. Doctor Lain has been a frequent contributor to the *Journal of the American Medical Association, Archives of Dermatology and Syphilology,* and various state journals, and has been quoted in textbooks on dermatology. He is a member of the American Medical Association and component societies. Doctor Lain's practice is limited to dermatology, syphilology, and radiotherapy, and he is professor of dermatology and radiotherapy, University of Oklahoma School of Medicine (since 1912).

# A USEFUL HINT FOR FRACTURE WIRING

C. L. MEISTROFF, D.D.S.
New York

REGARDLESS of the method of intermaxillary wiring used for fracture fixation, wires must be passed through the interproximate embrasures in order to attach the arch wires firmly to the teeth or to fasten the eyelets to the teeth.

The wire used is cut the length needed and then pushed through the interdental spaces. The wire cutters always leave a sharp and jagged edge on the end of the wire which on being pushed to place lacerates and rips the interdental papilla and often causes permanent injury to this structure. No matter how carefully the occlusion, fixation, or immobilization have been done there is hemorrhage and the trauma done is inexcusable.

If the eyelet method of wiring is done this means that two wires must be pushed through the interdental space, ripping the delicate papilla. If the wire is pulled through by means of dental floss then the doubled wire causes pain and trauma which results in unnecessary discomfort.

One end of the wires used for the interdental passage is flattened out with a hammer or all-metal surgical mallet. This produces a ribbon-like probe which can be pushed *between the tooth and the interdental papilla* without pain or trauma.

The advantages of this method are: (1) cleaner result; (2) less trauma; (3) more postoperative comfort to the patient, and (4) elimination of useless probing.

**Fig. 1—Diagrammatic sketch of the wire as it is usually used to wire up in fractures.**

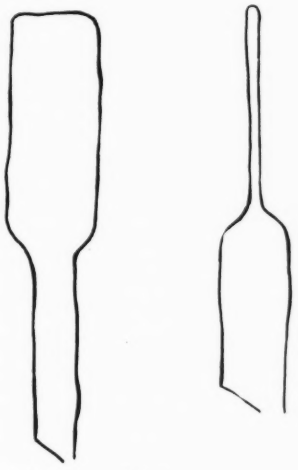

**Fig. 2—Edgewise and lateral views of the same wires shown in Fig. 1 after it has been flattened. Note the difference.**

Fig. 2

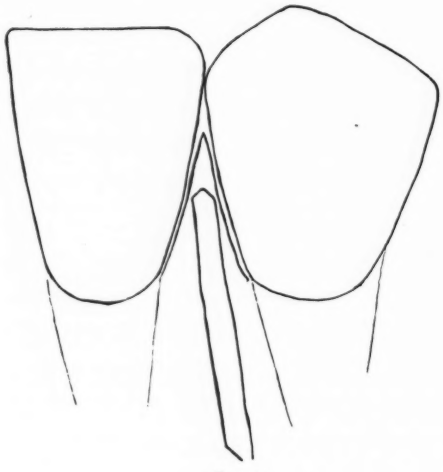

Fig. 3

**Fig. 3—A dental papilla and its relation to the teeth proximating each other and the interdental space. Note that the thick wire with its sharp edge will always catch the papilla.**

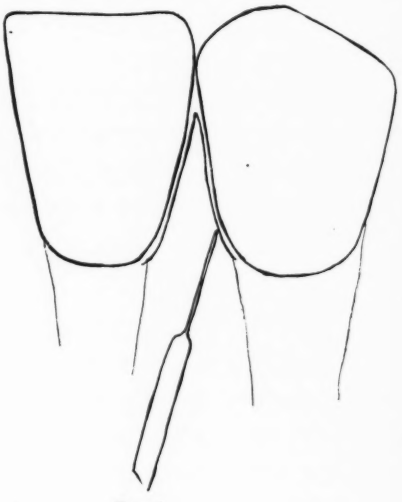

Fig. 4

**Fig. 4—Note how the flattened end of the wire compares to the interproximal embrasure and the papilla. The difference between Figs. 3 and 4 is obvious.**

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